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ABSTRACT

Four separate experiments were completed using the same stimulus materials but different groups of subjects to determine if orienting tasks created problems of control in incidental/intentional learning studies. Subjects were all Caucasians and heterogeneous in age (from 24 to 64 years), educational experiences, and career choices. Those in the first two experiments were enrolled in a continuing education class at a university, those in the third all worked for the same company, and those in the fourth were graduate students. In each case subjects were given nine words, three high frequency, three medium frequency, and three low frequency, and told to write as many synonyms for each as they could in two minutes. In addition, the intentional subjects were told to try to memorize the stimulus words. Analysis of the number of synonyms generated to the stimulus words on the orienting task and the number of stimulus words recalled revealed that intentional learners recalled significantly more stimulus words than incidental learners in three of the four experiments and that there was no significant difference among incidental and intentional learners on the orienting task in any experiment. The rehearsal time necessary to encode stimulus words by the intentional learners did not disrupt performance on the initial learning task. (JL)

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Word Frequency Effects on Memory and Incidental/Intentional Learning

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Word Frequency Effects on Memory

and Incidental/Intentional Learning

Criticisms of research in incidental/intentional learning studies are often based on two issues. First, has the initial learning task provided control of rehearsal time, and, second has the effect been established as a reliable finding? In regard to the first criticism related to incidental/intentional learning, Postman (1964) has pointed out that the orienting task creates problems of control. He specified two criteria that must be satisfied by the orienting task. First, exposure to the items to be learned must be assurred and, second, uncontrolled sets to learn must be minimized. McLaughlin (1965) has further stated that many early studies using that type I designs (Postman, 1964 and McLaughlin, 1965) can be criticized for failure to have the intentional learners engage in the orienting task. Concerning the second criticism an appeal is made to the psychology of science. Stevens (1963) stated that science is based upon propositions anchored in operations that are both public and repeatable. It is important, therefore, that a series of experiments be used to verify the reliability of specific findings.

In this study a series of four experiments was completed in which control was maintained by requiring both incidental and intentional learners to participate in the orienting task. The replication of the study with several groups was done to assure reliability of the findings. In an earlier study using the same design, Meinke (1969) has shown that there were no significant differences between incidental and intentional learners or between male and female subjects on the orienting task, that is, the number synonyms generated to a set of stimulus words. However, there was a significant effect for the frequency of occurrence of the stimulus word. More synonyms were generated for high frequently occurring words. When the number of the stimulus words recalled was used as the dependent measure, intentional learners

performed significantly better than incidental learners and female Ss recalled significantly more stimulus words than male Ss. Epstein (1974) found a significant sex effect in the opposite direction with males subjects recalling significantly more response items than female Ss after incidental learning. He concluded that his finding was an artifact of the study. Perhaps the significant sex effect in the Meinke study as well may be explained as an artifact. Therefore, the study was replicated four times with four different groups of subjects using a shorter stimulus word list but the same list for all four groups. It was expected that intentional learners would perform significantly better on the recall task while there would be no significant differences between incidental and intentional learners in their performances on the orienting task. No significant sex effects were anticipated assuming that Epstein's conclusion that the finding of a sex effect on the recall task was merely an artifact of the study. In keeping with the findings of Johnson, Meinke, Von Mondfrans, and Finn (1965) and Meinke (1969) the third hypothesis was that more synonyms would be generated to the high frequently occurring stimulus words than the low frequently occurring words. Based upon the previous findings of the Meinke (1969) study, no significant effect for the frequency of occurrence of the stimulus words on the recall task was anticipated, nor were any significant interactions expected.

METHOD

In this study four separate experiments were completed using the same stimulus materials but different groups of subjects. The analyses of the data were based upon two dependent measures, number of synonyms generated to the stimulus words on the orienting task and the number of stimulus words recalled.

Experimental Design. In the first experiment the experimental design was a 2x3 analysis of variance with repeated measures on the second variable. The first factor was incidental learners versus intentional learners, and the repeated measure was the frequency of occurrence of the stimulus words, high, medium, or low based upon the Thorndike-Lorge (1944) list. In the remaining three experiments four independent groups of Ss were tested in a group situation. Half of the Ss received intentional learning instructions while the other half received incidental learning instructions. Approximately half of the Ss were males and the other half were females. All of the Ss engaged in the orienting task in which each stimulus word was an example of one three levels of frequency of occurrence, that is, high, medium, or low frequency of occurrence in accordance with the Thorndike-Lorge (1944) list. The experimental design for these three experiments, then, is a 2x2x3 ANOVA with repeated measures on the third variable. The first bi-leveled factor was learning instructions (intentional, incidental), the second bi-leveled factor was the sex of the S (female, male), the third tri-leveled factor or repeated measure was the frequency of occurrence of the stimulus words. Two separate analyses of variance with repeated measures were performed. The performance on the orienting task was analyzed using the dependent variable of number of synonyms generated to the stimulus words. The recall performance of Ss was analyzed using the number of stimulus words recalled.

Subjects. The subjects for each of the experiments were all Caucasion, but heterogeneous in age, range 24-64, educational experiences, and career choices. There were fourteen males and four females in the first experiment. There were ten males and seven females in the second experiment. Both groups were enrolled in a continuing education class at the University of Toledo. In the third experiment

there were six female and eight male Ss who participated in a two-day workshop and were employed by the same company. The fourth group of Ss was made up of graduate students enrolled in a graduate course at the University of Toledo. There were eight females and seven males in the fourth experiment.

Apparatus and materials. The nine stimulus words were identical to the ones used in the Johnson et al. (1965) study. The three high frequency occurring stimulus words were ship, seem, and high; the three medium frequency occurring stimulus words were hasten, jewel, and steep; the three low frequency occurring words were invest, operator, and pinch. The words were obtained from the Thorndike-Lorge (1944) list and occurred more than 100 times in one million for the high frequency of occurrence words, 40-41 times per million for the medium occurring words, and less than 20 times per million for the low frequency of occurrence words. Each word was listed 15 times on one page of a booklet. Between each stimulus word space was provided for Ss to write a response, that is, a synonym to the stimulus word. This was done to minimize inappropriate responses such as associative chaining.

Procedure. Ss were run in a group with a retention test following after the completion of the orienting task. During the orienting task each stimulus word was presented for two minutes. There was approximately a five second delay between stimulus words while Ss turned the page. After completion of the time limit for the final stimulus word, E told the Ss to stop and collected the stimulus booklets. After four minutes had elapsed all Ss were instructed to recall as many of the stimulus words as could be remembered. Ss were given five minutes to recall stimulus words. The general instructions for all Ss were:

On each of the following pages you will find a list of words. Your task is to think of as many synonyms (i.e. words that mean the same) for the word that you can. Write down each word in the numbered space provided in the order of thinking of the word. You will have two (2) minutes for each of the words.

The specific instructions for the incidental and intentional learning groups were respectively:

Incidental - Try to think of as many synonyms as possible to the stimulus words.

Intentional - While you are thinking of synonyms for the stimulus words, try to memorize the stimulus words.

The general instructions were printed on the first page of the booklet containing the stimulus words. An example of a stimulus word with several synonym responses was also provided on the first page. The specific instructions were typed on 3x5 cards which were distributed at random to the Ss prior to the orienting task.

Results

The responses of the Ss to each of the stimulus words were examined and scored as a correct response if the word given was, indeed, a synonym of the stimulus word. The criterion for acceptable synonyms was the inclusion of the word in Webster's New Collegiate Dictionary or Roget's The sources of Words and Phrases. The responses on the recall task were scored correct if the response was one of the stimulus words. For each of the four experiments two analyses were completed using the number of synonyms generated to the stimulus words and the number of words recalled as the dependent variables. The first experiment employed a 2x3 ANOVA with repeated measures on the tri leveled factor, and the three other experiments used a 2x2x3 ANOVA with repeated measures on the last factor.

Mean scores and S.D.'s for both analyses for each of the four experiments are presented in Table 1. The largest number of synonyms

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Insert Table 1 about here

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generated occurred in the fourth experiment when the incidental female group generated an average of 9.75 words to the high frequency occurring words. The fewest number of synonyms generated was in the third experiment where the incidental female group generated 2.68 words to the low frequency occurring words. The recall of stimulus words for the four studies ranged from a high of 3 to a low of zero words for any one subgroup. The results of the ANOVA's for the four experiments are show in Table 2. When using the number of synonyms

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Insert Table 2 about here

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generated there were no significant difference between incidental or intentional learners, sex of Ss, or their interaction in any of the four experiments. In two experiments there were significant effects for frequency of occurrence of the stimulus words. In the first experiment the more words were generated to high frequency of occurrence words, then medium occurrence words, and least to low frequence of occurrence words. ($F_{2,32}=20.61$, $p < .01$) In the third experiment the frequency of occurrence was also significant ($F_{2,20}= 14.79$, $p < .0001$) but there was also a significant interaction effect in which the incidental/intentional learners condition interacted significantly with the frequency of occurrence of the stimulus words. ($F_{2,20} = 4.00$, $p < .0345$) There were no other significant effects in any of the experiments when using the number of synonyms as the dependent measure.

When using the number of stimulus words as the dependent measure, the intentional learners performed significantly better than incidental learners in experiments 1, 3, and 4. ($F_{1,16}$ =10.24, p < .01), ($F_{1,10}$ =14.72, p < .0033), ($F_{1,11}$ =27.12, p < .0003) There were no significant sex effects nor interaction effects with sex and incidental/ intentional learner condition. There was a significant effect for the repeated measure of frequency of occurrence of the stimulus words for each of the four experiments, ($F_{2,32}$ =9.94, p < .0004) ($F_{2,26}$ =4.25, p < .0253) ($F_{2,20}$ =15.16, p < .0001) ($F_{2,22}$ =13.37, p < .0002) There were significant interactions in the third and fourth experiment between frequency of occurrence of the stimulus words with incidental and intentional learning. ($F_{2,20}$ =11.31, p < .0005) ($F_{2,22}$ =4.28, p < .0269)

Discussion

The finding of significant effects where intentional learners recall signficantly more stimulus words than incidental learners was sustained in three of the four experiments. In none of the experiments was there a significant difference among incidental and intentional learners on the orienting task. It is clear that rehearsal time necessary to encode the stimulus words by the intentional learners does not disrupt performance on the initial learning task. This was also true in the Meinke (1969) study in which a longer list of stimulus words was used. An alternative explanation might simply be that a two minute interval is more than sufficient to exhaust a S's synonym response reservoir for most stimulus words and sufficient time remains for encoding and rehearsing of the stimulus words by the intentional learners.

The finding of no significant effects for sex on either the orienting task or the recall task in any of the four experiments is interesting. It may be that Epstein's (1974) conclusion that the sex effect was an artifact is not only right for his study but it may be a better explanation for the earlier finding of a significant effect in the Meinke (1969) study. It may also be possible that a larger sample size is necessary to detect a significant sex effect.

There are interesting results related to the frequency of occurrence variable. It was significant on the orienting task in only two of the four experiments but suprisingly was significant in all four experiments for the recall task. This is markedly different from Meinke's (1969) findings. He found a significant effect for this variable on the orienting task but not on the recall task. It seems reasonable to expect to find a significant effect for frequency of occurrence of words on the generation of synonyms. When one uses a word frequently, there may be a need to find a suitable substitute for the word so that the specific word is not overused. On the other hand if a word is used only once in a while, then the user need not find a substitute. In this way one would expect to find many synonyms for frequently occurring words but only a few synonyms for less frequently occurring words. Of course there is another possible variable that can enter into this consideration and that would be the pool size of synonyms available for each stimulus word. For example, there are very few synonyms for the word, seem, but many for the word, ship, even though both qualify as high frequency of occurrence words. This latter consideration may account for the finding on only two of the four experiments replicating the Meinke (1969) results.

Although Meinke (1969) did not find a significant effect on the recall task for the variable of frequency of occurrence, this variable produced a consistent significant effect in all four experiments. Apparently high frequency occurring words are recalled more easily than medium and low frequency

words. The significant interaction effects of this variable in two experiments with the intentional incidental learning variable can be used to show that the frequency occurrence effect functions differentially. In the plots of the interaction effects shown in Fig. 1 it can be seen in both cases that the intentional learners recall most of the stimulus words at the high frequency of occurrence level and then do a little less well on the medium and low frequency of occurrence words. The incidental learners do well on the high frequency words but fall off markedly on the medium frequency words and even more so on the low frequency words. These results pose an

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interesting question. Why would the incidental learners tend to recall well the high frequency words and not the medium or low frequency words? This may again be an artifact of the position of the word on the list. Even though the words were assigned at random to construct the list, it turned out that the first and last words on the list were high frequency words, namely, high and seem. The serial position effect of the words on the list may contribute to the high performance on the high frequency words and must be considered when interpreting the interaction effects and the main effect of frequency of occurrence as well.

References

Epstein, M. L. Sex differences in incidental learning and recall of related and unrelated word pairs. The Journal of Psychology, 1974, 88, 3-8.

Johnson, T. J., Meinke, D. L., Van Monfrans, A. P., and Finn, J. Word frequency of synonym responses as a function of word frequency of the stimulus and list position of the response. Psychonomic Science, 1965, 2, 235-236.

McLaughlin, B. "Intentional" and "Incidental" learning in human subjects. Psychological Bulletin, 1965, 63, 359-376.

Meinke, D. L. Stimulus properties sex of subjects, and their effects upon incidental and intentional learning. Proceedings 77th Annual Convention American Psychological Association, 1969, 4, 79-80.

Postman, L. Short-term memory and incidental learning. In A. W. Melton (Ed.) Categories of human learning. New York: Academic Press, 1964.

Stevens, S. S. Operationalism and logical positivism. In M. H. Marx (Ed.) Theories of Contemporary Psychology. New York: The Macmillan Company, 1963.

Thorndike, E. L., and Lorge, I. Teacher's word book of 30,000 words. New York: Teachers College, Columbia University, 1944.

Table 1 Means and SDs of the Number of Synonyms Generated and the Number of Stimulus Word Recalled by Ss in Four Experiments

Experiment Number	Dependent Variable	Learning Condition	Sex of S	Frequency of Occurrence of Stimulus Words: High M	High SD	Medium M	Medium SD	Low M	Low SD
One, n=18	Synonyms Generated	Intentional	N/A	9.44	4.03	6.89	3.33	4.89	2.15
		Incidental	N/A	9.00	3.35	6.79	2.39	4.69	1.50
	Stimulus Words Recalled	Intentional	N/A	2.67	0.50	2.11	0.93	2.56	0.53
		Incidental	N/A	2.67	0.50	1.11	0.60	1.78	0.97
Two, n=17	Synonyms Generated	Intentional	Male	5.50	3.32	4.50	1.73	3.75	2.22
			Female	6.25	4.65	3.75	2.63	5.75	3.30
		Incidental	Male	8.50	3.08	5.17	1.83	6.67	2.80
			Female	5.67	2.87	6.00	2.00	5.67	5.51
	Stimulus Words Recalled	Intentional	Male	2.50	0.58	1.50	1.29	2.25	0.96
			Female	2.25	1.50	1.50	1.29	2.25	0.96
		Incidental	Male	2.67	0.82	1.83	0.41	1.33	0.82
			Female	1.67	1.53	1.00	1.00	0.33	0.58
Three, n=14	Synonyms Generated	Intentional	Male	9.00	0.00	9.67	3.06	6.67	2.89
			Female	8.00	1.73	6.37	2.08	4.33	2.08
		Incidental	Male	6.60	1.67	8.80	2.28	4.80	2.17
			Female	8.67	3.06	5.33	2.31	2.68	2.08
	Stimulus Words Recalled	Intentional	Male	2.67	0.58	2.67	0.58	3.00	0.00
			Female	2.67	0.58	2.00	1.00	2.00	0.89
		Incidental	Male	2.60	0.55	1.40	0.89	0.20	0.45
			Female	2.67	0.58	1.00	1.00	0.00	0.00
Four, n=15	Synonyms Generated	Intentional	Male	8.50	2.52	6.00	2.83	6.25	1.26
			Female	9.00	1.41	9.50	5.07	6.75	3.30
		Incidental	Male	9.67	2.31	8.67	2.08	8.67	1.53
			Female	9.75	2.06	7.25	3.86	9.25	4.11
	Stimulus Words Recalled	Intentional	Male	3.00	0.00	2.75	0.50	2.25	0.96
			Female	3.00	0.00	3.00	0.00	2.75	0.50
		Incidental	Male	2.67	0.58	1.67	1.53	1.00	0.00
			Female	2.50	0.58	2.00	0.82	0.50	0.58

Table 2. Summary of the Analysis of Variance with Repeated Measures for Four Incidental/Intentional Learning Experiments

	Dependent Measures							
	Number of Synonyms Generated				Number of Words Recalled			
Source of Variance	Study 1	Study 2	Study 3	Study 4	Study 1	Study 2	Study 3	Study 4
Incidental/Intentional (I)	NS	NS	NS	NS	$p < .0056$	NS	$p < .0033$	$p < .0003$
Sex (S)	NA	NS	NS	NS	N/A	NS	NS	NS
S x I	NA	NS	NS	NS	N/A	NS	NS	NS
Frequency of Occurrence (F)	$p < .01$	NS	$p < .0001$	NS	$p < .0004$	$p < .0253$	$p < .0001$	$p < .0002$
F x I	NS	NS	NS	NS	NS	NS	$p < .0005$	$p < .0269$
F x S	NA	NS	$p < .0345$	NS	N/A	NS	NS	NS
F x I x S	NA	NS	NS	NS	N/A	NS	NS	NS

NS = Not Significant

N/A = Not Applicable

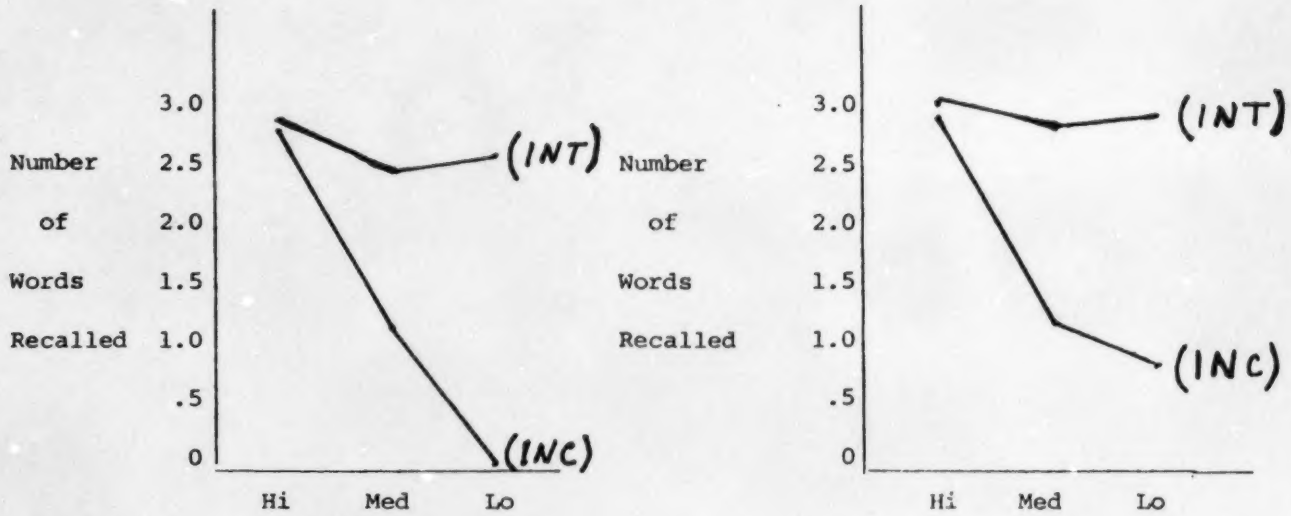

Figure 1. Interaction Effects of Frequency of Occurrence of Stimulus Words and Incidental and Intentional Learners